

PATENT
ATTY. DOCKET NO. SAMD/18US3

Ex parte Strauss et al.

Serial No.: 08/881,948
 Filed: June 25, 1997
 Group Art Unit: 1753
 Examiner: R. McDonald
 Applicant: Strauss et al.
 Title: MECHANICALLY JOINED SPUTTERING TARGET
 AND ADAPTOR THEREFOR

May 17, 1999

This brief is in furtherance of Applicant's Notice of Appeal filed February 17, 1999, appealing the decision of the Examiner dated November 17, 1998 finally rejecting

Thomas W. Humphrey
Reg. No. 34,353

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claims 9-13, 23 and 24. A copy of the claims appears in the Appendix to this brief. This brief is transmitted in triplicate.

Real Party In Interest

The real parties in interest in this appeal are Sony Corporation, a corporation of Japan having a place of business at 7-35 Kitashinagawa, 6-Chome, Shinagawa-Ku, Tokyo 141, Japan, and Materials Research Corporation, a corporation of Delaware having a place of business at 542 Route 303, Orangeburg, NY 10962.

Related Appeals and Interferences

There are no such appeals or interferences.

Status of Claims

Independent claim 9 and dependent claim 23 stand rejected under 35 U.S.C. §103(a), asserted to be obvious over Fujitsu (Japanese patent document 59-179784) in view of Zejda (U.S. Patent 5,112,467). Dependent claims 10-13 stand rejected as obvious based on the rejection of the independent claim, further in view of Inoue (U.S. Patent 5,244,556). Dependent claim 24 stands rejected as obvious based on the rejection of the independent claim, further in view of Wegmann (U.K. patent document 2,173,217).

Claims 9-13 were originally filed with the application. Applicant's Amendment of March 19, 1998 added claims 23-24, and amended claim 9. Applicant's Amendment of October 21, 1998 re-amended claim 9 and amended claims 10, 12, 23 and 24.

Status of Amendments

There are no amendments pending.

Summary of Invention

The invention relates to a target used in a sputtering process. In a sputtering process, a target comprised of material, such as Aluminum, to be sputtered, is placed in a vacuum chamber. A substrate to be sputtered is placed in the chamber and the chamber is evacuated. Once the chamber is evacuated, a process gas is introduced into the chamber at a low pressure, and a voltage is applied to the target. Ions in the chamber are accelerated by electric fields into the target, dislodging atoms of sputtering material from the target. The dislodged atoms sputter onto the substrate, forming, over time, a thin film of target material on the substrate.

The sputtering process described above slowly wears material from the target until, ultimately, the target must be renewed. Typically, this is done by removing the target from the chamber and simultaneously inserting a new target into the chamber. Often, the target material is soldered or otherwise bonded to a backing plate which is itself bolted to the chamber, in which case the entire target (target material and backing plate) must be replaced. In some prior art of record, the target is a single piece of sputtering material that is bolted or otherwise attached to the chamber, in which case the target may be replaced without manipulating or handling the backing plate.

In accordance with the present invention, a one-piece target, i.e., a single homogenous piece of sputtering material, is formed with threaded holes proximate to its

periphery, so that the target may be bolted to the interior of the chamber with bolts passing into the target.

Notably, because the holes in the target are threaded, bolts may be used to secure the target to the chamber interior without the use of a nut, washer or similar elements on the side of the target opposite to the bolt. Since bolt heads, nuts, washers and the like are often not made of the desired sputtering material, they should not be exposed to ion bombardment that would cause sputtering. Thus, it is an advantage of the invention that it is not necessary to have a bolt head, nut, washer or the like in the interior of the chamber near to the periphery of the target. It is a further advantage that the bolts holding the target may be removed without manipulating an opposing nut.

Issues

Whether the subject matter of any of claims 9-13, 23 and 24 is obvious in light of Fujitsu, Zejda, Inoue and/or Wegmann.

Grouping of Claims

For the purposes of this appeal, the claims will be argued to stand or fall together.

Argument

In his analysis of Fujitsu in his Final Rejection, the Examiner correctly notes that Fujitsu shows a one-piece, single-material, disk-shaped target, having planar surfaces, and at least one radially-inward step proximate the outer periphery. Also, the Fujitsu target

has holes near the outer periphery. But, as the Examiner has recognized, these holes are not threaded, whereas the present claims recite threaded holes.

To understand the importance of the threaded holes recited in the present claims, and the reason why Fujitsu entirely fails to suggest threaded holes, it is essential to evaluate in more detail the structure that is shown by Fujitsu.

Specifically, the Fujitsu target, seen best in Fujitsu Fig. 2, is intended to be installed to a backing plate by inserting bolts through countersunk holes 14 in the target 11. The bolts are inserted from the sputtering (interior) surface of target 11, and then threaded into threaded holes in a backing plate 12. The bolts are then tightened until the bolt heads rest inside of the countersinks of the holes 14, clamping the target 11 to the backing plate 12.

The holes 14 which pass through the target 11, are not threaded because threads are unnecessary. In the Fujitsu structure, when a bolt is fully inserted into a hole 14 in the target 11 and threaded into the backing plate 12 from the sputtering (interior) side, the head of the bolt rests against and mechanically engages the bottom of the countersunk opening of the hole 14, and it is this mechanical engagement that holds the target in place. There is no need to include threads in the hole 14 passing through target 11, since mechanical engagement of the bolt with the target 11 is already obtained by the interaction of the head of the bolt with the countersunk hole.

In fact, Applicant submits that a worker of average skill would appreciate that holes 14 passing through the Fujitsu target 11 should not be threaded, as doing so would make it much more difficult to achieve tight mechanical engagement between the target 11 and backing plate 12. If there were any minor misalignment between the threads in the

holes passing through the target 11 and the threads in the backing plate 12, this misalignment would prevent a threaded bolt from drawing the target 11 into engagement with the backing plate 12. If there were any such misalignment, torque applied to the bolt would merely translate into force applied between the head of the bolt and the threads in the target 11, rather than between the head of the bolt and the threads in the backing plate 12. By comparison, when the holes passing through the target 11 are not threaded, torque applied to the bolt always translates into force applied between the head of the bolt and the threads in the backing plate 12, clamping the target 11 to the backing plate 12.

To presumably motivate the inclusion of threaded holes in the Fujitsu target, the Examiner has incorporated the Zejda patent into his primary obviousness rejection. Zejda deals with a chamber for sputtering compact discs. The Zejda device has a donut-shaped target (compact discs are not sputtered in their central area), with threaded holes used to hold the target to the chamber. The Examiner's position is that one of ordinary skill would be motivated by Zejda to put threads in the holes of the target shown by Fujitsu.

With the foregoing background in mind, Applicant submits that a person of ordinary skill, whether or not referencing Zejda, simply would not put threads in the holes of the target shown by Fujitsu. Doing so would not only be pointless, but counter-productive, because it would make it harder to obtain good mechanical engagement between the Fujitsu target and chamber. The fact that Zejda shows threaded holes in the context of a different application, does not change the readily apparent disadvantage to putting threads in the holes in the Fujitsu target.

In response to the argument set forth in the previous paragraph, the Examiner in the Final Rejection has stated that "providing threaded holes can still achieve a tight

mechanical fit if screwed properly". While this may be true, it begs the question why a worker of average skill would modify the Fujitsu target in a way that has no advantage and makes it harder for the overall device to work properly. The question here is not what is possible, but what a worker of average skill would be motivated to change or not change. Applicant submits that, clearly, a change that would make the Fujitsu device less workable would be avoided, and could not be obvious.

Applicant would further note that Zejda is directed to an application that is totally different and in many ways incompatible with the application of Fujitsu. Applicant wishes to emphasize these incompatibilities, since they further demonstrate that the references would not and should not be combined in evaluating the obviousness of the present claims.

As the Examiner has noted, the Fujitsu device is a magnetron sputtering device, in which a magnet is brought into close proximity of the rear side of the target/backing plate assembly, to produce beneficial magnetic fields over the sputtering surface of the target. This means that there must be clearance for the magnets to approach the rear side of the target. It also means that the magnets and accompanying mechanism will crowd the rear side of the target/backing plate assembly. To accommodate these issues, the Fujitsu device inserts the target mounting bolts from the sputtering (inner) side of the target. Because the bolts are inserted from the sputtering (inner) side of the target, rather than from the backing plate (outer) side of the target, the bolt heads do not project into the vicinity of the magnets and as a result are more accessible (one does not need to move the magnet assembly aside to access the bolt heads) and there is also more clearance for the magnet assembly.

The Zejda device, in contrast, is used for non-magnetron sputtering of compact discs. Thus, Zejda's donut-shaped target does not have a magnet assembly on its rearward side. There are no magnets that need clearance to approach the rear side of the target, and there is no magnet mechanism crowding the rear side of the target/backing plate assembly. Under these circumstances, the Zejda device brings the bolts into the target from the backing plate (rear) side, which is an acceptable solution since there is no problem associated with the bolts projecting from the rear side of the target, and the bolts can be readily accessed.

Since the Fujitsu and Zejda devices are designed for radically different applications (magnetron vs. non-magnetron sputtering), and these applications have a profound impact on the positioning and manner of use of the target mounting bolts, Applicant cannot see any reason that these devices would be combined, or how a rational combination of the references, based only on the references themselves rather than hindsight reconstruction of what Applicant has claimed, could arrive at anything in particular much less the specific structure that is recited in the present claims, i.e., a disk-shaped target with threaded holes proximate to its outer periphery.

Applicant has asked the Examiner to identify specific, objective motivations for combining Fujitsu and Zejda to arrive at the claimed invention, and the bases in these documents for those motivations. In response, in the Final Rejection, the Examiner asserts that the targets of Fujitsu and Zejda "can be utilized for both magnetron and non-magnetron sputtering", and then proceeds to combine features of the targets from the two references. Applicant submits that this is an improper analysis. 35 U.S.C. §103(a) requires analysis of the "subject matter as a whole" when determining obviousness. It is

improper for the Examiner to look at the Fujitsu and Zejda targets in isolation, i.e., separate from the devices and context in which they are used, when deciding upon the obviousness of the "subject matter as a whole". Considering the full context of the Fujitsu and Zejda documents, there is no basis for the combination of these documents, and a clear motivation not to perform the combination identified by the Examiner.

Applicant notes the Examiner's citation of the Inoue and Wegmann documents with reference to some of the present dependent claims. While these references are not the primary bases for rejection, Applicant will comment briefly upon them.

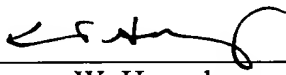
As to Inoue, the Examiner's remarks are directed to Fig. 2 of that patent, which shows a single-material target bolted to a chamber. Applicant would note, however, that in essence the structure of Fig. 2 is no different from that of Fujitsu, in that it shows a target with unthreaded holes mechanically bolted to a chamber by bolts inserted from the sputtering (inside) surface of the target. Fig. 2 thus brings one no closer to the claimed invention than Fujitsu does. Furthermore, Applicant would note that the single-material target Fig. 2, on which the Examiner relies, is illustrated as prior art by Inoue, and the background of the Inoue patent criticizes this target for its poor cooling features. Inoue teaches that the structure of Fig. 3, which is not a single-material target, is a superior structure. Inoue thus actually teaches away from a single-material target, rather than teaching toward one as the Examiner supposes.

Wegmann is cited only for showing multiple radially inward steps on the periphery of a target. It goes no further to showing the concepts absent from Fujitsu, Zejda or Inoue identified above, and so needs no further comment.

In conclusion, Applicant submits that none of the cited references show the claimed combination of features. More specifically, none of the cited references show or suggest a single-material target with threaded holes proximate to its outer periphery.

Accordingly, Applicant submits that the Examiner's rejection is in error and a reversal of the rejection and allowance of the claims is therefore requested.

Respectfully submitted,
Wood, Herron & Evans, L.L.P.

By 
Thomas W. Humphrey
Reg. No. 34,353

2700 Carew Tower
441 Vine Street
Cincinnati, OH 45202-2917

Voice: (513) 241-2324
Facsimile: (513) 421-7269

APPENDIX

9. (Twice Amended) A target for installation in a vacuum chamber for processing a substrate by causing sputtering material to be ejected from the target onto said substrate, comprising

a disk-shaped section having two planar surfaces and an outer periphery, said disk-shaped section having at least one radially-inward step proximate said outer periphery,

said target being manufactured homogeneously of said sputtering material,

said disk-shaped section defining threaded holes proximate said outer periphery of said disk-shaped section.

10. (Amended) The target of claim 9 wherein said disk-shaped section is sufficiently self-supporting to bear stress arising when said section is mounted to said vacuum chamber supported only proximate said outer periphery, and said chamber is evacuated to initiate sputtering, such that one planar surface of said section is exposed to vacuum pressure while an opposite side thereof is not exposed to reduced pressure.

11. The target of claim 9 wherein said sputtering material is a refractory metal.

12. (Amended) The target of claim 9 wherein said sputtering material is one of Titanium, Gold, and Aluminum.

13. The target of claim 9 wherein said sputtering material is Aluminum or an oxide thereof.

23. (Amended) The target of claim 9 wherein said disk-shaped section defines threaded holes opening into said at least one radially-inward step, proximate said outer periphery of said disk-shaped section.

24. (Amended) The target of claim 9 wherein said disk-shaped section has two radially-inward steps proximate said outer periphery.